

DESCRIPTION OF A NEW SPECIES OF NET-WINGED MIDGE
FROM THE GREAT BASIN, WITH A KEY TO THE NORTH
AMERICAN SPECIES OF THE GENUS *DIOPTOPSIS*
(DIPTERA: BLEPHARICERIDAE)

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ABSTRACT: The adult, pupa and larva of a new species of *Dioptopsis* are described and figured from material collected in Great Basin ranges in northeastern California and Nevada. The adult is peculiar among its congeners in lacking mandibles and having infusate wings. It is further characterized along with the immature stages in a key presented for all the North American member of the genus.

The amandibulate condition (with associated modifications of other head structures) of this species and others is discussed and a new term, colocephalous, is introduced to designate it.

Thanks to the exceptional field work of John F. Emmel and Oakley Shields over the past three years, material has accumulated of a previously undiscovered species of *Dioptopsis* in the Great Basin. For this contribution to my studies on the Blephariceridae of North America, I wish to express my appreciation to these spirited collectors. I wish also to thank J. A. Powell and A. Stone and their respective institutions, University of California, Berkeley—California Insect Survey Collection [CIS] and Agricultural Research Service, U.S. Department of Agriculture—U.S. National Museum [USNM], for the loan of additional and comparative material. The majority of the specimens recorded are in the Los Angeles County Museum of Natural History [LACM].

Dioptopsis dismalea, new species
(Figs 1-13)

Dioptopsis n. sp. Hogue, *in press*. Bull. Calif. Insect Survey.

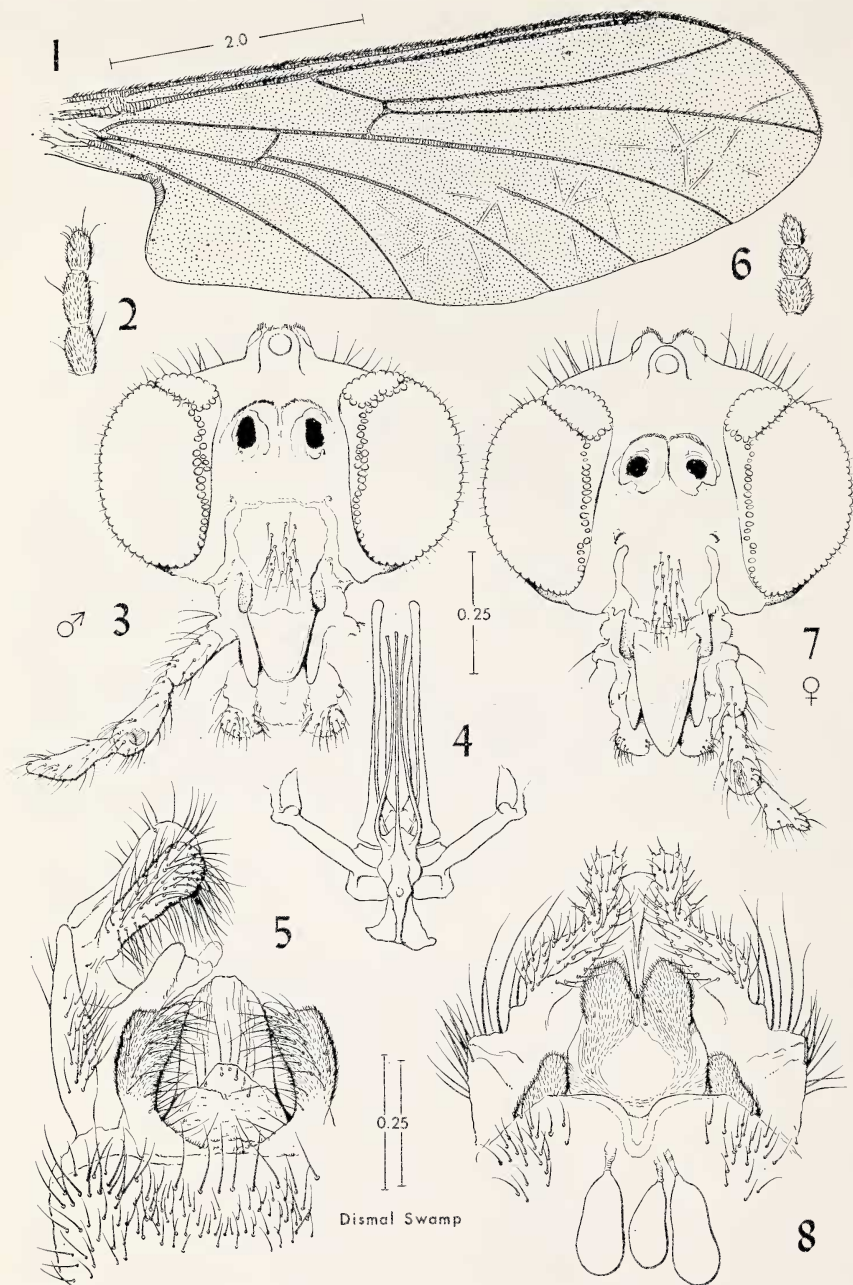
FEMALE (based on allotype; Figs. 6-8)

Size.—A medium sized blepharicerid. Measurements (lengths in mm):

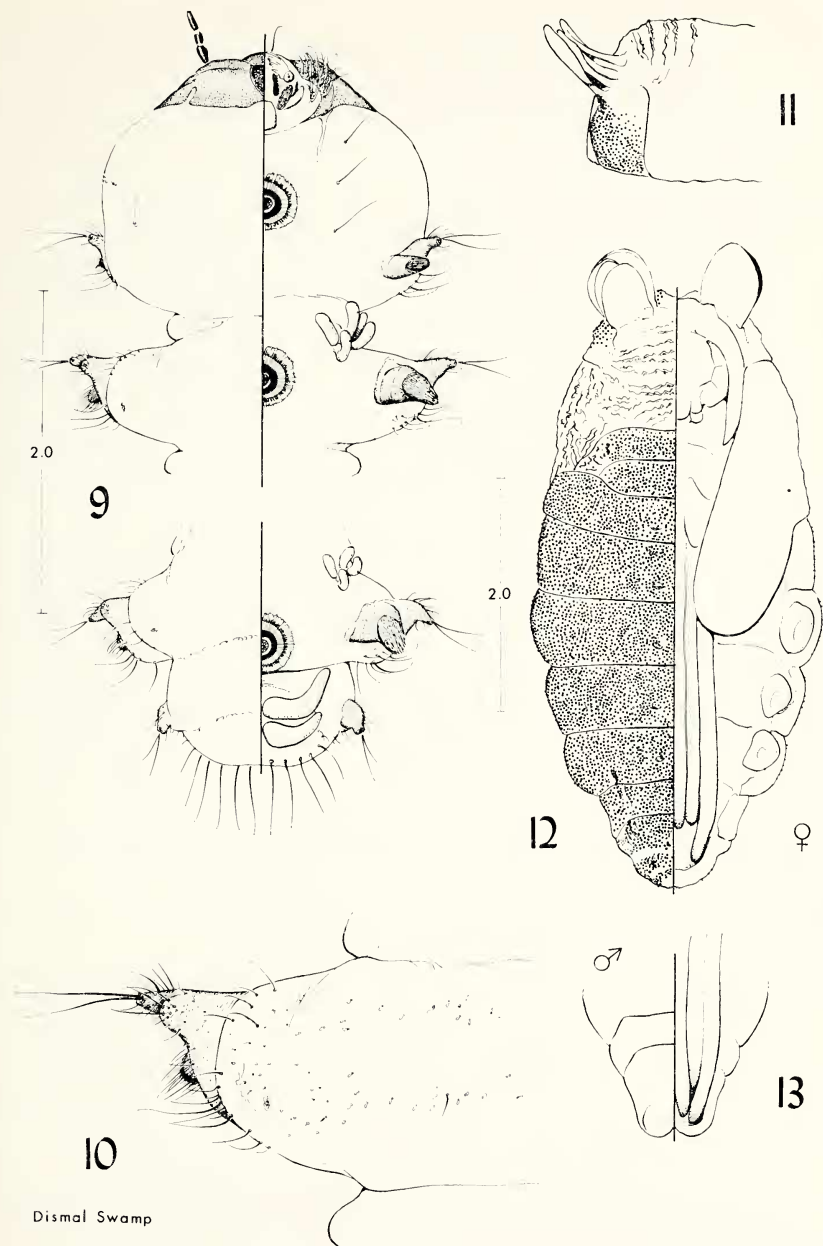
Body: 3.6 Wing: 5.7

Legs:	fore	mid	hind
femur	2.5	2.5	3.4
tibia	2.5	2.3	3.1
tarsus 1	1.2	1.0	1.4
2	0.3	0.3	0.4
3	0.25	0.25	0.25
4	0.2	0.2	0.2
5	0.4	0.4	0.4

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Figures 1-8. *Dioptopsis dismalea*, n. sp., Adult. 1. Wing. 2. Terminal antennal segments, male. 3. Head, male. 4. Phallosome complex, male genitalia. 5. Male genitalia. 6. Terminal antennal segments, female. 7. Head, female. 8. Female genitalia.



Figures 9-13. *Diptopsis dismalea*, n. sp. 9. Larva. 10. Details of typical median abdominal segment. 11. Pupa, lateral view of anterior end. 12. Pupa (female). 13. Terminal end of male pupa.

Coloration.—General integument melanic, well sclerotized. Head, including antennae, all black. Mesoscutum brownish laterad, large antero-medial rectangular area black, pruinose mesad, shiny black laterad; mesonotal sutures, supraanterior pronotal areas, supraalar, scutoscuteellar notches and postscutellum, all shiny black. Scutellum gray pollinose. Pleuron generally brown, lower sternopleuron and metepimeron contrasting black. Haltere even gray. Legs gray-black, darker at joints and distal half of tarsal segments 5. Wing membrane tinged sooty-black. Abdomen evenly black, slightly pruinose.

Head.—Figure 7. Eyes widely separated; upper eye division small, 7-9 rows of ommatidia along maximum vertical arc; not well differentiated from lower division, no unfacetted strip, ommatidia of both divisions equal in size. Antenna short, 14 segmented, shape and length of flagellar segments subequal except basal which is approximately 2.0 length of others, ultimate segment slightly smaller than penultimate (Fig. 6). Mouth parts short, mandibles entirely lacking, hypopharynx truncate, with weak marginal teeth. Palpus 4-segmented, terminal segment (4 and 5) swollen ventromesad, subtriangular in shape.

Thorax.—Scutellum with dense lateral setal patches, connected by a single row of setae across caudal periphery; a few supraalar and prescutellar bristles, anterior pronotum bare; other sclerites nude. Legs with tibial spurs 0-0-2, spurs of hind tibia unequal. Wing shape, venation and trichiation as figured (Fig. 1).

Genitalia.—Figure 8. Oviscapt deeply cleft mid-posteriorly. Spermathecae moderate in size, one smaller than other two and elongate-ovoid, others elongate-ovoid, slightly constricted mesally.

MALE (based on holotype; Figs. 1-5)

General.—Slightly larger than female. Measurements (lengths in mm):

Body: 3.6 Wing: 6.0

Legs:	fore	mid	hind
femur	2.9	3.3	4.3
tibia	3.1	2.8	4.1
tarsus 1	1.8	1.4	1.8
2	0.6	0.5	0.6
3	0.4	0.4	0.4
4	0.3	0.3	0.3
5	0.4	0.4	0.5

Coloration.—Generally darker than female. Essentially sooty-black all over; abdominal pleural membranes contrasting white. Wing membrane tinged sooty-black as in female.

Head.—Figure 3. Practically indistinguishable from that of female. Eyes widely separated. Hypopharynx truncate, marginal teeth absent. Tip of labrum

entire. Antenna short; 14-segmented, relative size and shape of segments as in female.

Thorax.—Chaetotaxy as in female, a few bristles on anterior pronotum. Legs with tibial spurs 0-0-2, hind pair very unequal. Wing as in female.

Genitalia.—Figures 4 and 5.

PUPA (Figures 11-13)

Size.—Small to medium. Measurements (overall length in mm): ♂ range 4.9-5.6, mean ($n = 4$) 5.1. ♀ range 5.2-6.0, mean ($n = 10$) 5.5.

Coloration.—Dorsally all black, no pattern.

Structure.—Figures 11-13.

LARVA (final instar; Figures 9 and 10)

Variation.—Fortunately material has recently come to hand from a third locality, in the Jarbidge Mountains, to indicate that this species is discordantly variable in respect to several features of the male genitalia and one pupal character. Formerly, specimens whose differences suggested the existence of two geographical subspecies were only available from the Warner Mountains of California and Ruby Mountains of Nevada.

In the genitalia of the male the following characters are notably variate. (1) Angle of projection of the 9th tergite lobes. The lobes tend to lie straight and parallel, thus angled at about 90° from the posterior margin of the segment, in the Ruby Mountain populations and variously curved and convergent in the other two populations. (2) Extent of bristles on the sides and venter of the basistyle. These bristles are mostly lateral but a few stray mesoventrad, especially in the Nevada populations. (3) Shape of tip of the paramere. Usually the apex of this organ is rounded and slightly inturned with the canal running nearly to the end. In some specimens from the Jarbidge Mountains, the apex is extended beyond the canals to form a spatulate process. (4) Shape of dorsal lobe of outer dististyle. In dorsal aspect this lobe appears club shaped and straight in the Jarbidge Mountains specimens but tend to be capitate and incurved in males from the Ruby and Warner Mountains. (5) Length of ventral projection of the inner lobe of the dististyle. This process variously exists as a short point hardly longer than the body of the main lobe, to a long fingerlike projection curving up and beyond the latter.

A dimorphism occurs in the extent of dorsal integumentary stippling on the pupa. In the California populations, these structures terminate abruptly short of the lateral margins leaving a clear zone around most of the abdominal periphery. Nevada pupae show the stippling strongly up to, and even carrying ventrad of, the lateral edge of the abdominal segments.

Range: The species is now known only from extreme western and eastern mountains in the Great Basin and Range geological system. It is certain to be found throughout the intervening ranges where streams occur at elevations of over 7000 feet.

Diagnosis: The pigmented wing of this species is unique among *Dioptrissis*, the wing membrane of all other species being hyaline. Other characteristics to distinguish adults and the immatures are given in the keys below (see Discussion).

Type Locality and Material: The types of this species come from streams draining Mount Bidwell through a large meadow in the Warner Mountains of extreme northeastern California (Modoc County) called Dismal Swamp (119° 10' W, 41° 59' N). Specific collections are as follows:

HOLOTYPE: ♂, (genitalia on slide No. CLH 6809-3) and **ALLOTYPE,** ♀, (genitalia on slide No. CLH 6809-6): Dismal Swamp, 7200 feet, 15-16 July 1968 (J. Emmel and O. Shields) [LACM].

PARATYPES: 5 ♂♂, 6 ♀♀: same data as holotype (one pair completely dissected, on slides) [LACM, USNM].

8 ♂♂: creek just west of Dismal Creek, 7300 feet, 15 July 1968 (Emmel and Shields) [LACM].

ADDITIONAL SPECIMENS: CALIFORNIA, Modoc County. 65 pupae and pupal skins: creek just west of Dismal Creek, 7300 feet, 15 July 1968 (Emmel and Shields) [LACM].

103 pupae: Dismal Creek, 7300 feet, 15 July 1968 (Emmel and Shields) [LACM].

3 pupae: stream west slope Mount Bidwell, 1 mi. S Dismal Swamp, 8000 feet, 16 July 1968 (Emmel and Shields) [LACM].

66 pupae, 75 larvae: Dismal Swamp, 8000 feet, 15 July 1948, 1950 (W. W. Wirth) [USNM, CIS].

NEVADA, Elko County. 27 pupae and pupal skins, 81 larvae: stream connecting Island Lake and Lamoille Creek, Ruby Mountains, 8800-10,000 feet, 8 August 1967, 29 June 1968 (Emmel and Shields) [LACM].

16 ♂♂, 75 pupae: Bonanza Gulch, 7800-8000 feet, Jarbidge Mountains, 23 July 1969 (Emmel and Shields) [LACM].

18 pupae: creek west of Angel Lake, 8600 feet, East Humboldt Range, 26 July 1969 (Emmel and Shields) [LACM].

Biological Notes: All localities where *D. dismalea* has been taken lie between 7300 to 10,000 feet elevation. The habitats are accordingly subalpine and alpine but vary to a considerable extent in several features important to blepharicerid ecology. According to Emmel (personal communication), "The Dismal Swamp is a large wet meadow (not a swamp, really) with willow thickets around the edges. There are scattered patches of thick Pine forest on the surrounding slopes. The "swamp" is not in a basin or valley as such, but is on the edge of a high plateau which slopes toward the east, just east of the crest of the Warner Mts. Several very small streams flow into the Dismal Swamp from the slopes above it on the west and south sides. Probably the largest of these streams are two flowing from the slopes of Mt. Bidwell. The streams flow through open aspen forest just above the edge of the large wet meadow; it is in these areas of open aspen forest where blepharocerid material was most

common. Larvae or pupae were not found more than several hundred yards away from the Swamp (although the streams [terminated] not too far above the areas where pupae stopped appearing), nor in the Swamp itself. Larvae and pupae were found on stones ranging in size from 1" diameter up to 6" diameter (which were probably the largest rocks). The stream rocks were generally very dark in coloration, although not usually as dark as the pupae on them. A few pupae were also found in a small stream high on the western slope of Mt. Bidwell where there was no forest; small willow thickets surrounded this stream. In all areas where blepharocerid material was collected, the stream habitat here was in contrast to other blepharocerid stream habitats in which we have collected, in that these streams were mere trickles (although this was a very dry year) rather than rushing torrents of abundant water as is usually the case. The observation that larvae and pupae were on relatively small rocks (the only ones available) is also of interest. The habitat of this species is noticeably different from that of . . . the Ruby Mountains locality . . . [which] . . . looks very much like a typical stream in the high altitudes of the eastern slope of the Sierra Nevada. Lamoille Canyon has been well glaciated; many streams flow down its steep slopes in the early summer. The stream in which larvae and pupae were found flows down an open slope into Lamoille Creek; blepharocerid material was found in the swiftest water, on dark rocks (probably granite). The whole area looks not unlike the higher altitudes of the Sierra Nevada, and it is well watered. Aspens are more abundant than conifers at this altitude; trees occur in scattered patches, never as extensive forest."

The site in the stream above Angel Lake in the East Humboldt Range is like the preceding, a nearly vertical narrow cascade down a rough granite face of a steep glaciated valley. There is scarcely any vegetation in the immediate vicinity of the stream. On the other hand at Bonanza Gulch, in the Jarbidge Mountains, the gently tumbling stream in the bottom of a broad ravine flows through a jumble of log and debris jams and is heavily overgrown with tall clump grass and willows.

Discussion: The new species clearly shows a complete lack of mandibles. This is a normal condition in only one other North American blepharicerid, *Blepharicera ostensackeni* Kellogg, but occurs consistently in many exotic species and in populations (subspecies ?) of *Dioptopsis aylmeri* (Garrett) in the eastern drainage of the Sierra Nevada (Hogue, in press). Associated with the amandibulate condition is a complete rearrangement in head proportions including a much shortened labrum and other mouthparts, weak hypopharyngeal teeth, widely separated eyes and reduced upper eye divisions. This type of head may be designated, "colocephalus" (Gr. *Kolos*, stunted, incomplete).

The genetic and phylogenetic significance of colocephaly which is anomalous in some species and normal in others, deserves special study. I have expressed (Hogue, in press), as has Edwards (1929:35-36), the opinion that such a total reorganization of head construction could come about by pleio-

trophic effects of simple mutations. Thus what would appear to be a profound set of differences upon which new species or other taxa might be based actually may easily and frequently arise in individuals or populations (even becoming dominant in one or more geographic areas as has presumably occurred with eastern Sierran *D. aylmeri*) of a single species. A trimorphic or even quadrimorphic condition could exist wherein a species may have males and females alternately with or without mandibles and with associated modified head structure. Such a hypothesis was long ago advanced by Muller but was refuted by other dipterists (Alexander, 1958:814) on the grounds that examples of dimorphic females actually belonged to different species. I believe the phenomenon needs further study to determine its extent, cause, and adaptive significance.

With the discovery of *D. dismalea*, the genus *Dioptopsis* in North America now consists of six species:

1. *aylmeri* (Garrett, 1923). Can. Ent. 55:244 (*cheaini* Garrett, 1925, to be placed in synonymy in forthcoming work by author). Widespread in western Canada and the United States.
2. *sequoiarum* (Alexander, 1952). Bull. Brook. Entomol. Soc. 47:91. California, western Sierra Nevada.
3. *dismalea* Hogue, 1969. Great Basin Ranges.
4. *arizonica* Alexander, 1958. Bull. Brook. Entomol. Soc. 53:50-51. Arizona, Sierra Ancha Mountains.
5. *alpina* Hogue, 1966. Los Angeles Co. Mus. Nat. Hist., Contrib. Sci., 120: 1-5. Northern and southern California.
6. *markii* (Garrett, 1925). Seventy New Diptera, p. 5. Recorded only from northern California, Washington and Alberta.

The first three species are very close relatives and may be united into an Aylmeri group. The primary basis of the grouping is a common larval type. In spite of the colococephalous heads of adult *dismalea* giving it a markedly different character from *aylmeri* (with the exception of certain populations as mentioned above) and *sequoiarum*, the species are indistinguishable in the larval stage. *Arizonica* and *alpina* together form a second natural grouping on the basis of features I have outlined elsewhere (Hogue, 1966:5). *Markii* stands alone with very different larval, pupal and adult characteristics.

The following keys will facilitate identification of the adults and immatures of all these species, with the exception of *arizonica*, whose female, pupa, and larva are unknown.

KEY TO NORTH AMERICAN *DIOPTOPSIS* SPECIES ADULTS

(Female of *arizonica* unknown)

1. *General*: Wing membrane infuscated. Palpus four segmented.....*dismalea*
General: Wing membrane hyaline. Palpus five segmented..... 2

2. *General*: Upper eye division at least one-fifth to one-fourth the area of lower in males (at least 11-12 rows of ommatidia), greater than lower in females 3
General: Upper eye division greatly reduced, much smaller than lower in both sexes, a small area of 4-7 rows of ommatidia..... 4
3. *Male genitalia*: Paramere with conspicuous mesal spur. Mesal margin of IX tergite lobe produced into a nude flange (i.e. without micro- or macrochaetae). *Female genitalia*: Spermathecae ovoid.....*aylmeri* (in part)
Male genitalia: Paramere simple, without spur. Mesal margin of IX tergite lobe not produced. *Female genitalia*: Spermathecae elongate-ovoid*sequoiarum*
4. *General*: Antenna with 15 segments. Mid-tibial spur present though minute. *Male genitalia*: IX tergite lobe short, only 2 times width. Lobe of outer dististyle short and projecting dorsomesad..... 5
General: Antenna with 14 segments or less. Midtibial spur entirely absent. *Male genitalia*: IX tergite lobe elongate, length 5-6 times width. Lobe of outer dististyle elongate and projecting subparallel to dististyle face 6
5. *Male genitalia*: Tip of inner dististyle lobe recurved.....*alpina*
Male genitalia: Tip of inner dististyle lobe with cup-shaped depression *arizonica*
6. *General*: Ultimate antennal segment smaller than penultimate. Female mandible reduced to absent. *Male genitalia*: Paramere with spur. *Female genitalia*: Spermathecae pear-shaped.....*aylmeri* (in part)
General: Ultimate antennal segment longer than penultimate. Female mandible normal sized. *Male genitalia*: Paramere simple. *Female genitalia*: Spermathecae ovate.....*markii*

PUPAE

(Unknown for *arizonica*)

1. Branchial sclerite strongly lobed, projecting well beyond cephalic sclerite in lateral aspect.....*alpina*
Branchial sclerite weakly lobed, cephalic sclerite visible from lateral aspect 2
2. Branchial lamellae spreading, caudal pair strongly convergent, often overlapping*markii*
Branchial lamellae all subparallel..... 3
3. Length/width of anteriormost branchial lamella 1.1 or larger.....*dismalea*
Length/width of anteriormost branchial lamella 1.0 or smaller..... 4
4. Interbranchial index (=interbranchial distance at base of lamellae/width of anteriormost lamella) less than 0.7. Rugae of posterior region of scutum forming a line running parallel to hind margin of sclerite *sequoiarum*

Interbranchial index greater than 1.0. Rugae of posterior region of scutum random, not forming a line.....*aylmeri*

LARVAE

(Unknown for *arizonica*)

1. Dorsal tubercles and plates present.....*alpina*
Dorsal integument without tubercles or plates..... 2
2. Antenna indistinctly segmented, basal $\frac{3}{4}$ membranous. Ventral gill tuft of segment 6 diminutive, with only 2 filaments. Dorsal pseudopods gently curving cephalolaterad.....*markii*
Antenna clearly 3 segmented, middle segment much smaller than others. Ventral gill tuft of segment 6 subequal to others, with 5 filaments. Dorsal pseudopods angular, tips project ventrolaterad.....
.....*aylmeri, sequoiarum, dismalea*

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